CT/AU00/00422

REC'D 29 MAY 2000

#2

AUSTRALIA

4

Patent Office
Canberra

I, LEANNE MYNOTT, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PQ0171 for a patent by LEXTAR TECHNOLOGIES LIMITED filed on 06 May 1999.

COMMONWEALTH OF AUSTRALIA
AUSTRALIA
PATENT OFFICE

WITNESS my hand this
Twenty-third day of May 2000

L. Mynott

LEANNE MYNOTT
TEAM LEADER EXAMINATION
SUPPORT AND SALES

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

P/00/009
Regulation 3.2

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: A SYSTEM FOR SURVEILLANCE OF AN AREA

The invention is described in the following statement:

GH REF: P50767A/CLC:SB

A SYSTEM FOR SURVEILLANCE OF AN AREA

The present invention relates to a track mounted carriage having a camera located thereon.

In a typical video surveillance system as disclosed in Australian patent 659190 a surveillance system consists of a track assembly which is mounted to the ceiling of a room. A movable carriage is able to travel repetitively back and forth along the track and is provided with a camera to send video images of the monitored areas to remote areas.

The carriage typically includes two cameras, a drive assembly, drive control and video circuit boards. The cameras are mounted to the support platform at different angles in order to observe the whole area which is being monitored.

The track includes two conductors of copper tubing suitably mounted and supported within semi-cylindrical grooves of an isolation block made of electrically insulating material. Each conductor is in slidable contact with at least one corresponding isolated slidable electrically conductive brush located on the underside of the carriage.

Output signals from the cameras are provided to a video modulator board on the carriage which modulates suitable carrier signals for transmission through the conductors to a demodulator connected at the end of the track. The demodulator demodulates each camera output signal from its respective carrier signal and displays the corresponding image on monitors.

Proximity sensors are located along the length of the track and these are hardwired back to the controlling interface system so that the location of the carriage is able to be monitored through the proximity sensors.

Power to the carriage is provided through the two conductors, so that the conductors carry both the power, control and video signals received from the cameras.

The above system has the drawback that it is not possible to accurately monitor more than one area at a

single time because the single carriage carrying the cameras cannot be at two locations along the track at the same time.

The present invention provides an alternative system for surveillance of an area which includes multiple carriages on a single track.

According to the present invention there is provided a system for surveillance of an area, including a track, a plurality of carriages locatable on the track and adapted for movement thereon, camera means mounted on each carriage for monitoring an area under surveillance and a control means for controlling operation of each carriage on the track and collision avoidance means for preventing any one carriage from colliding with an adjacent carriage.

It is preferred that the track includes a plurality of conductors which run along the length of the track.

Preferably the control means includes sensor means for detecting the position of each carriage of the track.

The sensor means preferably includes a plurality of position indicators positioned at intervals along the track.

The plurality of position indicators are preferably located at regular intervals along the track.

Each carriage preferably includes a sensor for sensing the distance travelled by the carriage over a predetermined time period.

Each sensor on the carriage preferably includes a wheel which is able to rotate, whereby rotation of the wheel represents the distance travelled by the carriage.

The control means preferably includes the position indicators and the carriage position sensor.

It is preferred that the collision avoidance means includes carriage monitor means for monitoring the position of each carriage on the track.

It is preferred that the control means includes the collision avoidance means.

The carriage monitor means preferably correlates

data received from the carriage position sensor and the [illegible] of each carriage at a particular instant of time.

The collision avoidance means preferably includes an interface translator which is adapted to receive data from the position indicators and each of the carriages and store data on the position of each carriage based on the data received from the position indicators and the carriages.

It is preferred that the interface translator includes a data processing means which includes position management software which stores the data relating to the position of each carriage on the track and controls movement of each carriage whereby collisions between adjacent carriages are avoided.

The position management software preferably includes buffer zone means which determines the minimum distance permitted between adjacent carriages and records this minimum distance in memory.

The position management software preferably includes priority means for allocating a priority value to each carriage at a particular time, whereby a carriage allocated a highest priority is commanded by the position management software to move to a predetermined location on the track when the interface translator receives a command signal from a master controller.

It is preferred that the control means includes the master controller which is connected electrically to the interface translator.

The interface translator preferably includes a microprocessor which is controlled by the position management software, memory storage means for recording the position of each carriage and the minimum distance, a track receiver/transmitter means for communicating data between the interface translator and the carriages and a controller receiver/transmitter means for communicating data between the master controller and the microprocessor.

It is preferred that the position management software includes polling means for polling each carriage at predetermined time intervals to monitor the location of each carriage.

It is preferred that the interface translator includes means for changing the rate of polling of carriages depending upon whether a carriage is moving or stationery or according to the speed of one or more carriages.

It is preferred that the conductors include three conductors, one for carrying power, another for carrying video and control signals and another being a ground conductor.

It is preferred that each carriage includes a carriage data processor for recording the position of the carriage along the track and for transmitting data relating to its position along the track, to the interface translator.

It is further preferred that each carriage data processor includes carriage memory for storing data on the location of each adjacent carriage.

It is preferred that each carriage data processor is able to receive and store data relating to the position of each adjacent carriage from the interface translator and/or each adjacent carriage.

It is preferred that each carriage receives and transmits data at a predetermined frequency which frequency is different from the predetermined frequency of an adjacent carriage.

According to another aspect of the present invention there is provided an insulative insert for a track, the insulative insert having a base portion and a pair of upstanding portions, each with a barb portion which is adapted to engage with a recess of an insert receiving portion of a track, whereby removal of the insert is prevented by the barb portions engagement in the respective recesses.

Preferably a conductor is adapted to be received

between adjacent upstanding portions.

It is preferred that the outer pair of upstanding portions are located on opposing sides of the base portion.

The base portion may be substantially flat.

The insert may be an elongate member.

It is preferred that the insert is configured like a U-shaped channel.

The upstanding portions preferably comprise vertical walls.

It is preferred that the insert includes three upstanding portions.

It is preferred that one of the upstanding portions is a central portion intermediate the opposing sides of the base portion.

The barb portion may be an upwardly extending peripheral lip.

The barb portion may be located at an upper end of the outermost upstanding portions.

It is preferred that each barb portion is adapted to engage a wall of a recess of the conductor receiving portion to prevent upward withdrawal movement of the insert from the conductor receiving portion.

A preferred embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a schematic drawing of a video surveillance system in accordance with a preferred embodiment of the present invention;

Figure 2 shows a block diagram of electric components of a carriage of the video surveillance system shown in Figure 1;

Figure 3 shows electrical components of an interface unit of the video surveillance system shown in Figure 1;

Figure 4 shows electrical componentry of an interface translator of the interface unit shown in Figure 3;

Figure 5 shows a flow diagram of software used in

the interface translator shown in Figure 4;

Figure 6a shows a track for a three conductor video surveillance system shown in Figure 1;

Figure 6b shows an insulator insert for the track shown in Figure 6a;

Figure 7a shows a track for a two conductor video surveillance system shown in Figure 1; and

Figure 7b shows an insulator insert for the track shown in Figure 7a.

The video surveillance system according to one example includes a track 11 with three carriages 12, 13, 14 (video transport units - VTU's). As shown in Figures 6a and 7a the track has the overall appearance of a channel with side walls 15, 16 which slant outwardly and upwardly. A rail section 17 is centrally located and upstanding with a U-shaped insulator 18 centrally inserted as shown in Figure 7a and a E-shaped insulator 19 inserted on its side centrally as shown in Figure 6a.

Each carriage 12, 13, 14 which is not shown in detail consists of a driver section 20, a camera section 21 and a microprocessor section 22. The carriage is supported on wheels which ride on the track 11. Spring loaded brushes of the carriage 12, 13, 14 contact the conductors 71 thus enabling power, video and control signals to be transmitted between each carriage 12, 13, 14 and an interface unit 20 which is connected to the conductors at one end of the track.

If the track shown in Figure 6a is used and thus three conductors are employed the interface unit includes terminals for connection to each of the conductors.

Inside the interface unit a filter and mixer are connected directly to the ground, power and communication line of the track. The filter and mixer 21 are also connected to video receivers which are each then connected to a respective demodulator which is hard wired to a monitoring system such as a video display unit where the images from each of the cameras of the carriages can be displayed.

A power supply is connected to the filter and mixer and may be a stand alone battery unit or may be also connected to a remote power source.

The filter and mixer 21 is also connected through a data transceiver modulator and demodulator 28 to an interface translator 29 as shown more clearly in Figure 4.

The interface translator consists of an input driver 30 and an output driver 31 which are connected to a microprocessor 32. The microprocessor includes memory 33.

A master controller 34 is connected to the output driver 31.

As shown in Figure 2 each carriage 14 includes a carriage interface unit 40 having a filter and mixer 41 which is connected to each of the conductors of the track 11. A power supply 42, video transmitter 43 and data transceiver modulator and demodulator 44 of the carriage 14 are all connected to the filter and mixer 41.

The video transmitter 43 is connected to a video modulator 45 which is connected directly to camera 46 which monitors an area under surveillance.

The data transceiver 44 is connected to a driver 47 which is then connected to a microprocessor 48. The microprocessor 48 is connected to both the camera 46 and a servo control 49 which controls movement of the carriage 14.

Anti-Collision System

Because the track 11 in the preferred embodiment has three carriages 12, 13, 14 which are movable along it, it is important that there is no collision between adjacent carriages.

In order to prevent collisions it is preferred that each carriage know the location of adjacent carriages. Accordingly a central control has been adopted in the present invention and this involves the interface translator 29.

The interface translator 29 is effectively a

microprocessor which provides the interface between the master controller 34 and the data transceiver module 28. Inside the interface translator 29 both hardware and software is used to control movement of each of the carriages 14.

The interface translator 29 stores positional information on each of the carriages 14 in its memory 33. The positional information is provided from data sent by each carriage 14 about its location on the track 11. Each carriage 14 includes an encoder (not shown) in the form of a measurement wheel which rotates as the carriage 14 moves along the track 11. Bar codes along the track and markings on the measurement wheel are monitored by a sensor which transmits signals to the microprocessor 48 which is then able to store data on the position of the carriage 14. Thus the microprocessor 48 stores positional information on its carriage 14 and as the carriage moves, memory in the microprocessor is updated so that the microprocessor 48 is always aware of its carriages location on the track 11.

At the same time the microprocessor 48 is recording the position of its own carriage 14. It is also transmitting data on its location through the driver 47, data transceiver 48 and filter and mixer 41 along a common communication conductor of the track 11 where the interface translator is able to receive this positional data through filter and mixer 21 and data transceiver 28 for processing by its microprocessor 32.

Because each of the carriages are effectively identical they are each able to store data on the location of their own carriage along the track 11 and are equally able to transmit this data on the common communication conductor of the track 11 where this data can be received by the interface translator 29.

The transmission of data from each carriage occurs on a common frequency. Accordingly because there is only one communication line which is used by all the carriages, the interface translator 29 operates to ensure

that only one carriage transmits data at any one time. [illegible] of the carriages 12, 13, 14 have a unique address.

The interface translator 29 addresses each carriage 12, 13, 14 in turn and requests the positional information and status of each carriage.

The carriage 12, 13, 14 which recognises this unique address is the only carriage which responds to a command from the interface translator 29. The response from the commanded carriage 12, 13, 14 contains its current positional information and status.

The above sequence of events is part of a standard polling process by the interface translator 29. The polling process occurs continually even if there is no movement or activity of any one carriage 12, 13, 14 on the track. The rate at which each carriage and its unique address is polled is dependent upon the number of carriages on the track 11. This polling rate is typically one to two per second. If the information translator 29 detects an active status on any carriage, during the normal polling routine, it immediately increase the polling rate to the active carriage. This process is called refresh. The rate at which refresh occurs is directly related to the number of active or moving carriages on the track 11 at any one time. This refresh rate is typically 6 to 10 per second.

The information which is returned by a particular carriage 12, 13, 14 during refresh allows the interface translator 29 to update the last known location of the active carriage at a more frequent rate.

When it is desired to monitor a particular location, the master controller 34 transmits command signals to the interface translator 29. The interface translator 29 has a record of the location of each of the carriages stored in its memory 33. Consequently when one particular area must be monitored it selects the closest carriage to move to a location on the track where monitoring can occur. Accordingly as part of the process of commanding one of

the carriages to move it must firstly allocate priority to each of the carriages 12, 13, 14 according to its distance along the track from the final destination along the track where monitoring is to occur. If there is any positional conflict between carriages because they are both within a similar distance from the desired destination, the interface translator 29 ensures that neighbouring carriages do not encroach on a buffer zone which has been preselected and stored in memory. It follows therefore that if two carriages move to a desired destination and cannot get to the final destination because they both would enter the buffer zone between them, the carriage with the highest priority would be instructed to move to the desired destination while the adjacent carriage with the lower priority would move away from the desired destination to ensure the buffer zone is maintained.

In addition to the above, each carriage and its microprocessor 48 stores data, including the address, on the position of each other carriage 12, 13, 14 on the track 11. The microprocessor is also able to receive data transmitted by other carriages 12, 13, 14 along the common communication conductor of the track 11. Because each carriage 12, 13, 14 is aware of the location of other carriages on the track 11 an active carriage 12, 13, 14 will immediately stop if the positional data it has stored on adjacent carriages indicates that a conflict has arisen because the moving carriage 12, 13, 14 has entered a buffer zone. The buffer zone as determined by the interface translator 29 is typically 2.4 metres. Accordingly if the moving carriage finds that it is within 2.4 metres of an adjacent carriage it immediately stops. The interface translator 29 then is able to issue commands to the conflicting carriages 12, 13, 14 so that the carriage 12, 13, 14 allocated the highest priority can move to the desired destination while the other carriage 12, 13, 14 moves far enough away so that the buffer zone is maintained.

As part of the anti-collision system, barcodes can be located along the track at regular intervals to provide reference points for correcting any discrepancies which may occur due to loss of power or encoder inaccuracies. These bar codes are sensed by bar code detectors located on each of the carriages 12, 13, 14. The bar code detectors and wheel indicators together provide positional data to the microprocessor 48 of its carriage 12, 13, 14.

With the anti-collision system described above a fail safe positional management system is achieved for each of the carriages 12, 13, 14, whereby the interface translator 29 is able to manage positional/movement commands from the master controller 34 and allocate priority to the appropriate carriage 12, 13, 14 to satisfy such requests as alarm activated presets and tours. The interface translator 29 is thus able to act as an arbitrator if there is a conflict of position requests received from the master controller 34. The interface translator 29 thus ensures that neighbouring carriages 12, 13, 14 do not encroach on the buffer zone. If for some reason however this policing action by the translator 29 is interrupted there is still a second level of conflict avoidance provided by the carriages 12, 13, 14 monitoring the position of other carriages 12, 13, 14 on the track 11.

Positional data on each of the carriages 12, 13, 14 is mapped into separate memory locations allocated with the specific address of a respective one of the carriages 12, 13, 14. A similar mapping process occurs in storage locations of the microprocessor 48 of each of the carriages 12, 13, 14. Each of the microprocessors 48 of the carriages 12, 13, 14 also store data on the buffer zone with the result that each microprocessor 48 can determine when its carriage 12, 13, 14 is in conflict with a neighbouring carriage 12, 13, 14. Unlike the interface translator 29 however the microprocessor 48 of each carriage 12, 13, 14 does not have the ability to

solve the conflict that it has with a neighbouring carriage 12, 13, 14.

Figure 5 shows a typical flow diagram of a controller request received from the master controller 39. Thus in the example where the master controller 34 requests a carriage 12, 13, 14 to move forward as represented by block 50 a command signal is sent to the interface translator 29 which receives the request as shown in block 51. The interface translator 29 then interprets and processes the request as shown in block 52. The interface translator 29 then determines whether the command is valid in block 53. If it is not valid then further action is stopped as shown in block 54.

If all the position parameters of each carriage 12, 13, 14 is maintained then the interface translator 29 transmits a forward command to one of the carriage 12, 13, 14 as shown in block 55.

In block 56 the carriage 12, 13, 14 receives the forward command from the interface translator and is also constantly listening for update positional data broadcast from other carriage 12, 13, 14 on the track as represented in block 57.

Movement of the carriage 12, 13, 14 is then initiated and positional updates are continuously broadcast from the moving carriage 12, 13, 14 to the common communication conductor of the track 11 as represented in block 58.

Neighbouring carriages 12, 13, 14 receive the broadcast from the moving carriage 12, 13, 14 as shown in block 59 and thus update their own records to maintain the most recent data on the position of each of the carriages 12, 13, 14 on the track 11.

The microprocessor 48 of the moving carriage 12, 13, 14 constantly monitors whether the command from the information translator 29 is current as shown in block 60.

If the command is current the carriage 12, 13, 14 repeats the step shown in block 56. If the command is

not current then the carriage 12, 13, 14 stops as shown in block 9.

The track 11 is specifically designed for the use of multiple carriages 12, 13, 14 and includes a central rail section 17 with a central channel along its length which is adapted to receive an insulator element 18 or 19 as shown in Figures 6a to 7b.

If a three conductor track is used as shown in Figures 6a and 6b, the insulator 19 is essentially E-shaped with the three legs of the E, 60, 61 and 62 oriented as upstanding elements and the side wall of the E being the base 64.

The outer upright legs 60, 62 are provided with a V-shaped channel 65 in their upper faces and outwardly extending lip or gutter portion 66.

The central leg has a head section 67 which tapers inwardly to an upper top surface 68.

The rail 17 has a small recess 69 located in an upper end of each side wall of the channel 70.

Each of the recesses 69 are shaped to receive respective lips 66 of the insulator 19, whereby lengthwise insertion of the insulator 19 into the channel 17 ensures engagement of the lip 66 of each leg 60, 62 in the respective recess 69. As a result of the insertion of the insulator 19 it cannot be moved vertically due to the engagement of the lip 66 with the upper wall of the recess 69.

The elongate conductor elements are inserted between each of the legs 60, 61 and 61, 62 and in conjunction with rail 17 which acts as a ground conductor, three conductive elements 17, 71 and 72 are provided for the track 11.

A similar two-legged insulator 18 is shown in Figures 7a and 7b. According to this embodiment a single conductive element 71 is located between the legs 69 of the insulator 18. As with the previous embodiment the rail 17 acts as a ground conductor.

With the surveillance system described above each

camera 21 of a carriage 12, 13, 14 is able to pan continuously through [illegible], tilt [illegible], zoom and focus. The carriage 12, 13, 14 provides linear movement for the camera along the track and continuous monitoring of multiple areas within a monitored zone is possible using the unique anti-collision system previously described. Thus with the above system a control station containing a master controller and multiple carriages 12, 13, 14 is able to view more than one area at the same time.

Variations and modifications can be made in respect of the invention described above and defined in the following statement of claims.

1. A system for surveillance of an area, including a track, a plurality of carriages 12, 13, 14 locatable on the track and adapted for movement thereon, camera means mounted on each carriage for monitoring an area under surveillance and a control means for controlling operation of each carriage on the track and collision avoidance means for preventing any one carriage from colliding with an adjacent carriage.

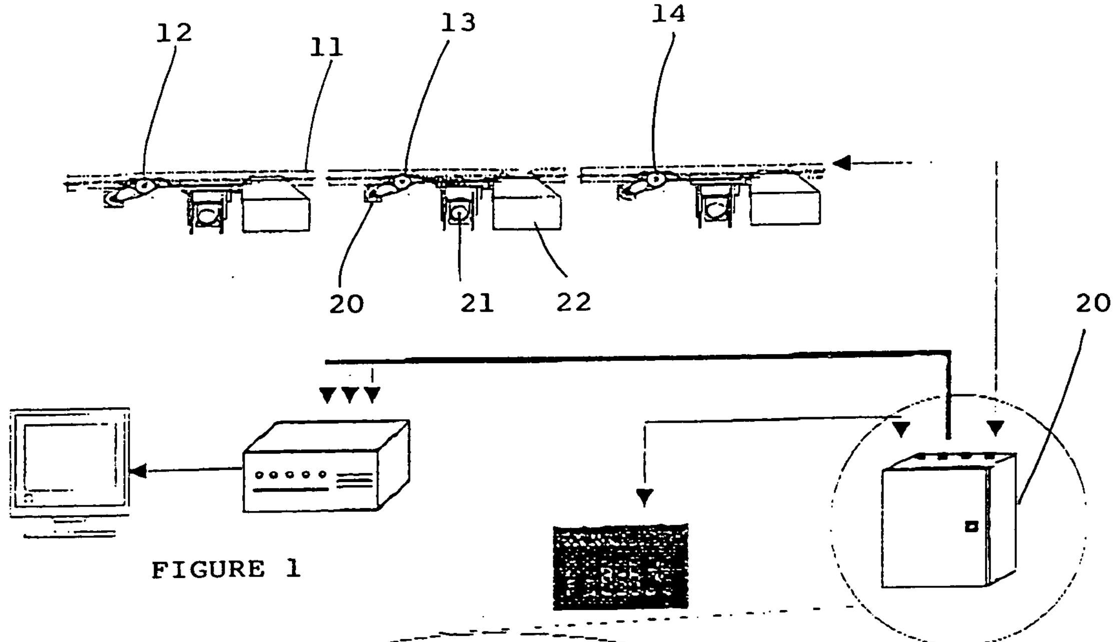


FIGURE 1

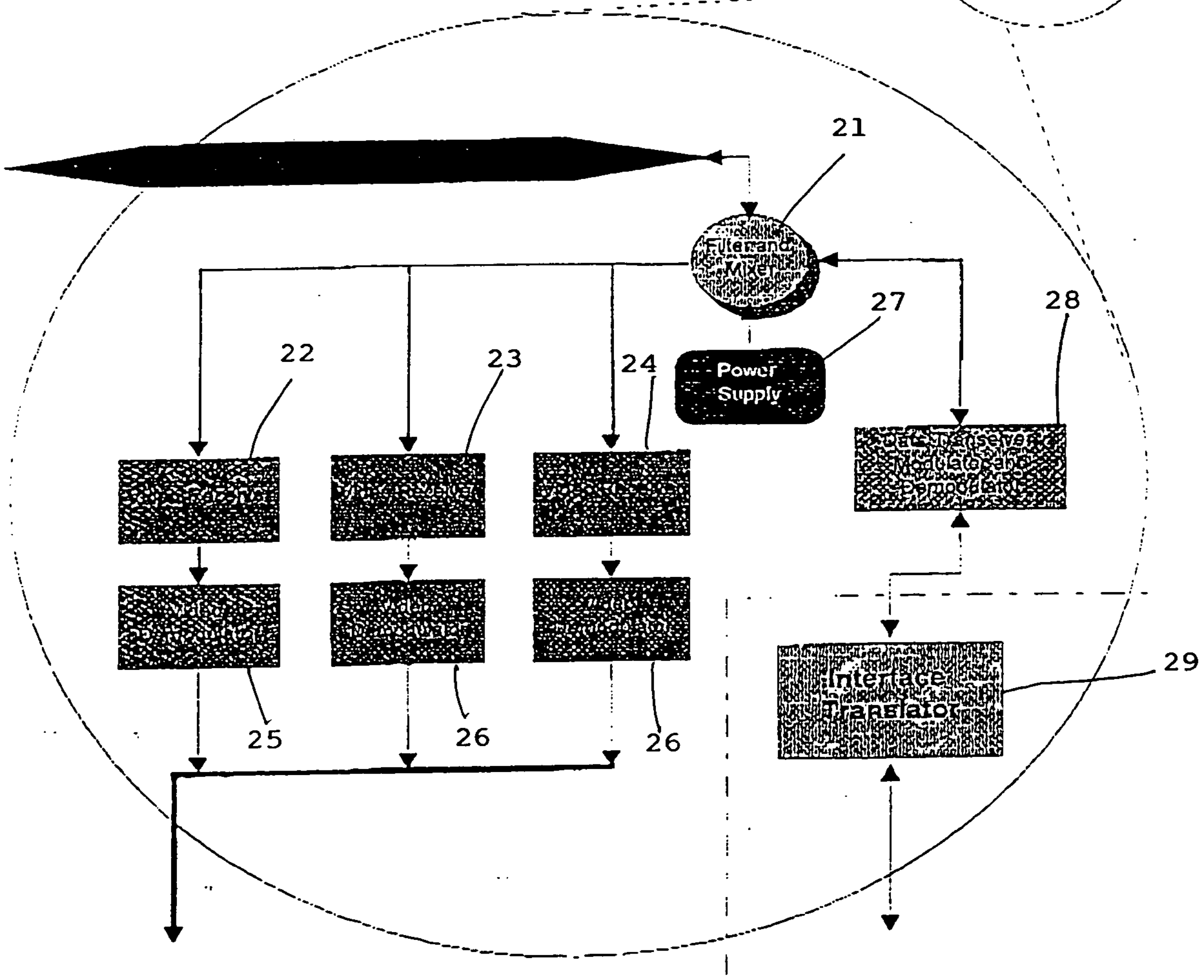


FIGURE 3

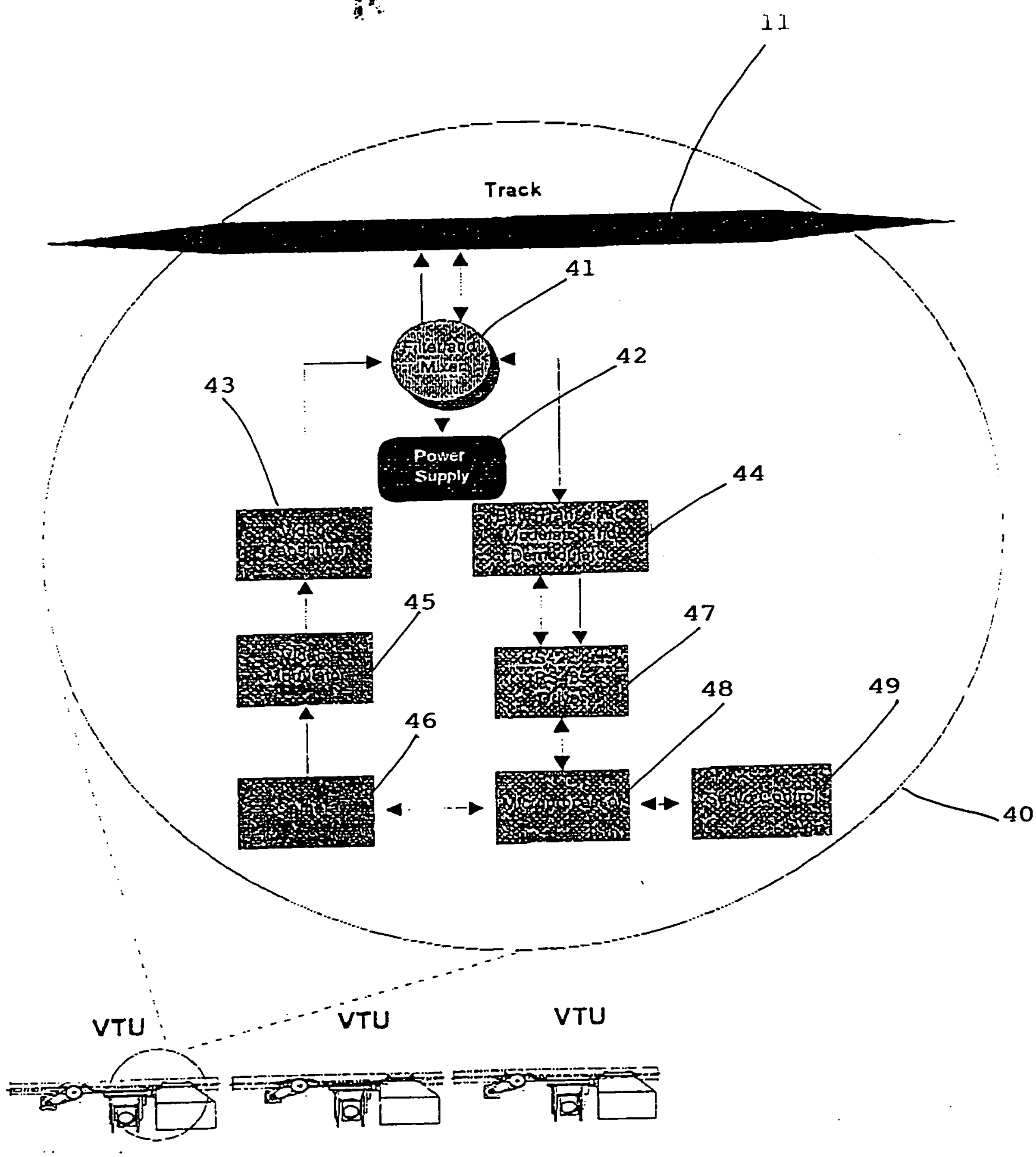


FIGURE 2

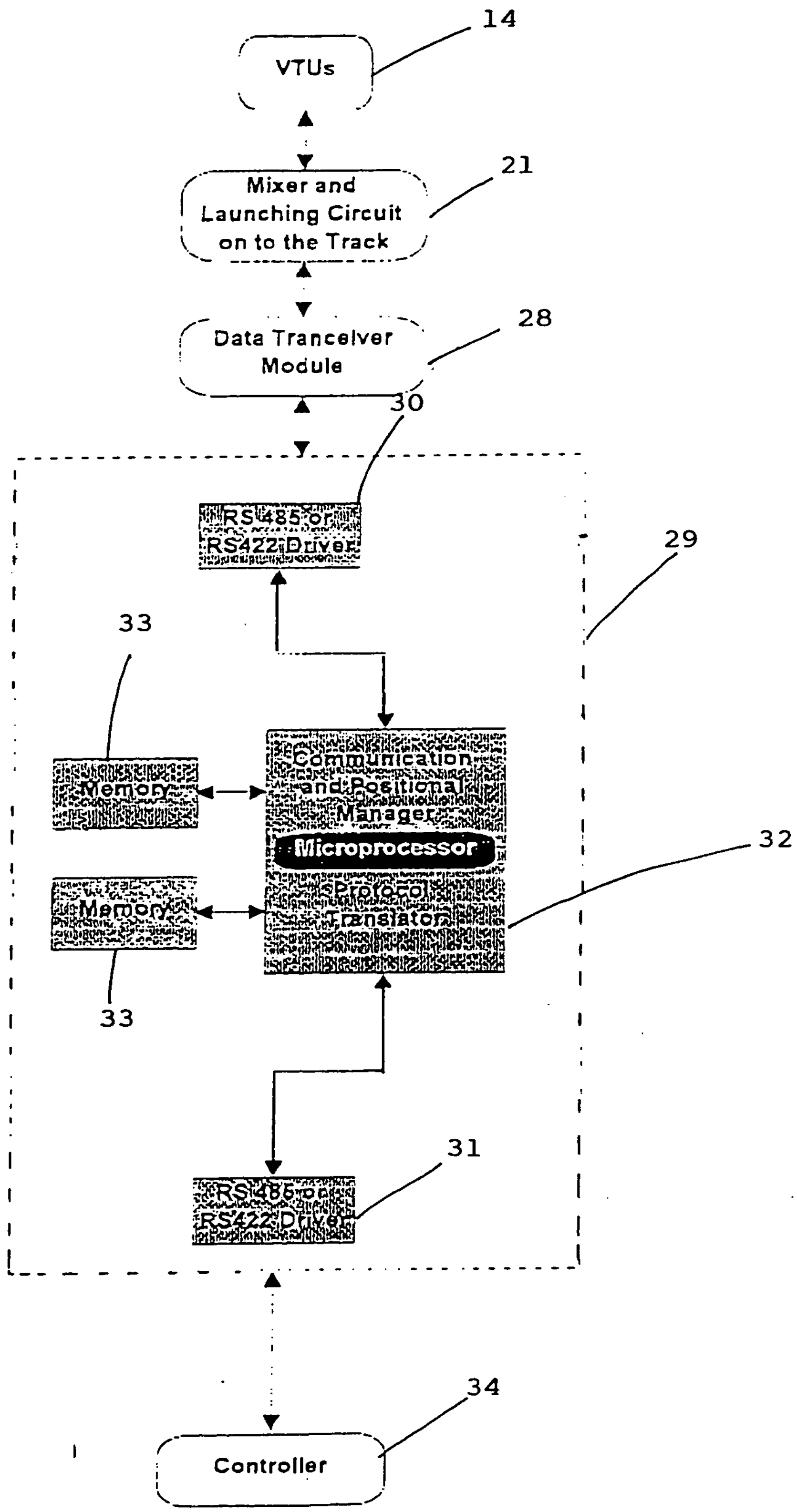

14
VTUs
21
Mixer and
Launching Circuit
on to the Track
28
Data Trancelver
Module
30
RS 485 or
RS422 Driver
29
33
Memory
Communication
and Positional
Manager
Microprocessor
Protocol
Translator
32
Memory
33
31
RS 485 or
RS422 Driver
34
Controller

FIGURE 4

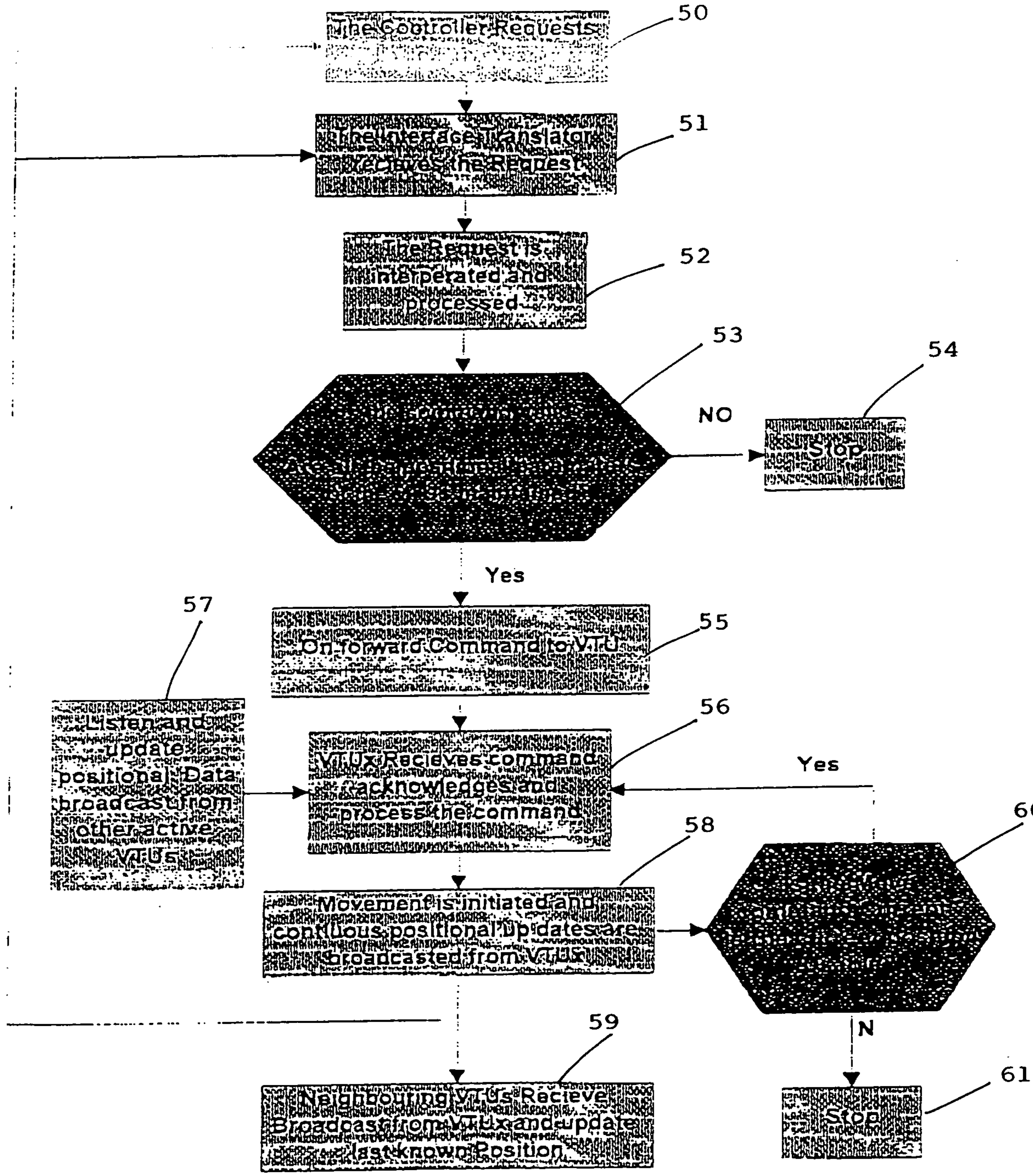

The Controller Requests
50
The Interface Translator receives the Request
51
The Request is interperated and processed
52
53
54
NO
Stop
Yes
57
On forward Command to VTU
55
56
Listen and update positional Data broadcast from other active VTUs
VTUx Recieves command acknowledges and process the command
Yes
58
60
Movement is initiated and contiuous positional Updates are broadcasted from VTUx
59
N
61
Neighbouring VTUs Recieve Broadcast from VTUx and update last known Position
Stop

FIGURE 5

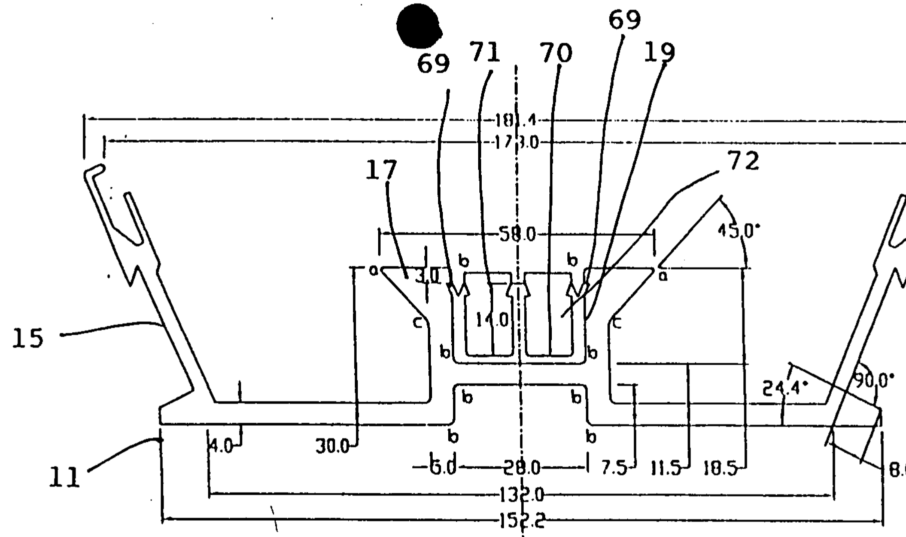
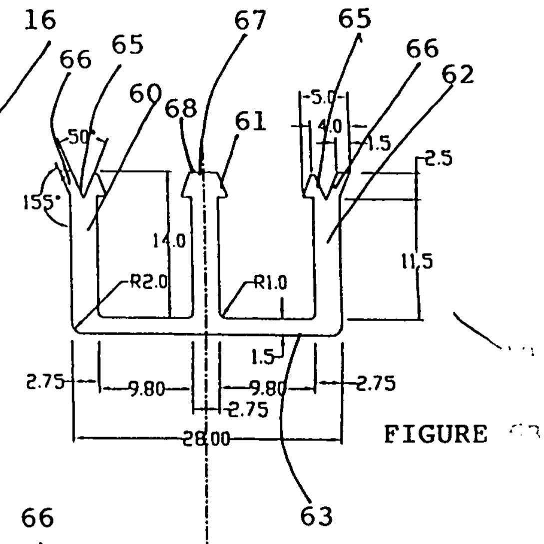


FIGURE 6A



FIGURE

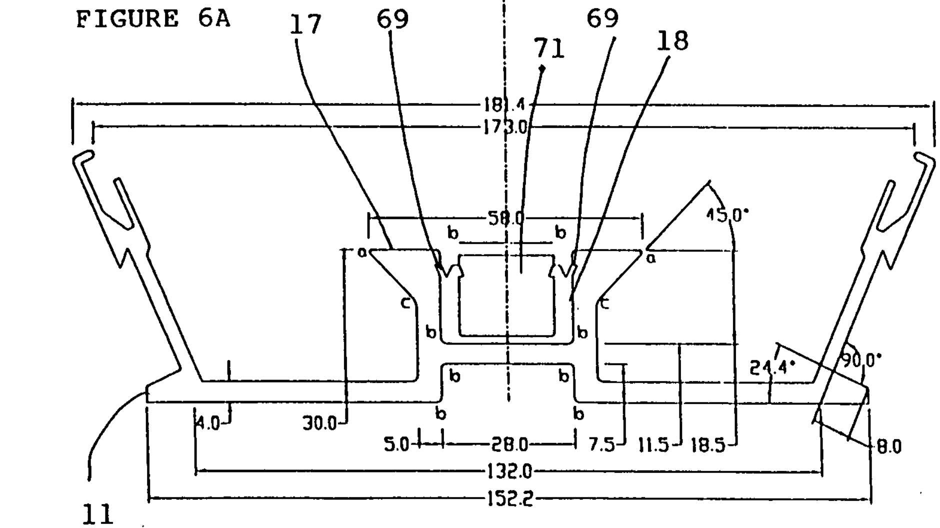


FIGURE 7A

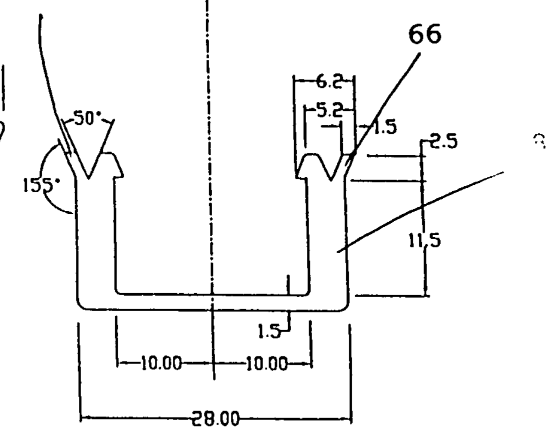


FIGURE 7B